Notice No.3

Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels, July 2021

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: June 2022

Amendments to	**Effective date**	**IACS/IMO implementation (if applicable)**
Part A, Section 2	1 July 2022	N/A
Part A-1, Section 6	1 July 2022	N/A
Part A-1, Section 7	1 July 2022	1 July 2022
Part B-1, Section 16	1 July 2022	N/A

Part A
2 General

2.1 Application

LR 2.1-08 Plans and information to be submitted

LR 2.1-08c In addition to the plans required by the Rules for Ships, the following information and plans are to be submitted, where applicable:

The following plans and particulars for type A independent tanks are to be submitted for approval before construction is commenced:
- Details and procedures of the hydropneumatic or hydrostatic test.
- Supporting calculations to demonstrate that the tank test condition complies with 16.5.2.

The following plans and particulars for type B independent tanks primarily constructed of plane surfaces are to be submitted for approval before construction is commenced:
- Details and procedures of the hydropneumatic or hydrostatic test.
- Supporting calculations to demonstrate that the tank test condition complies with 16.5.3.

Part A-1
Specific Requirements for Ships Using Natural Gas as Fuel

6 Fuel Containment System

6.4 Regulations for liquefied gas fuel containment

6.4.15 Tank types

(Part only shown)
LR 6.4-38 The scantlings of the fuel tanks are to comply with the requirements of LR 6.4-39 and the following:
(g) Internal bulkheads (Non-perforated).

(i) Where a bulkhead may be subjected to an internal pressure head, P_{eq}, resulting from loading on one side only, the scantlings of plating and stiffeners are to be determined from (b) and (c), *see also* (j).

(ii) Where no such loading condition is envisaged, and where the arrangement of the centreline bulkhead in way of the tank dome creates a common vapour space between the port and starboard sides of the tank, the scantlings may be derived as follows:

The thickness of plating and the section modulus of stiffeners are to be derived from (b) and (c) respectively, but P_{eq} (in MPa) need not exceed the greater of:

~~$\frac{hp}{1,02\times10^5}$,or~~

~~P_{HP} - P_{air}, or~~

$\boxed{\frac{h\ \rho}{1,02\times10^5}}$ or $\frac{a_{\cancel{y}y} b_{\cancel{t}t}\ \rho}{1,02\cancel{x}\times10^5}$

where
~~P_{HP} = tank testing load~~
~~P_{air} = air test pressure~~
$b_{\cancel{t}t}$ = maximum breadth from centreline bulkhead to tank side
a_y = maximum dimensionless accelerations in transverse direction

In such instances, due consideration is to be given to the tank testing procedures and the ~~loading manual~~ Loading Manual is to include the following note:

‘Centreline bulkhead scantlings of fuel tanks are approved for symmetrical filling levels either side of the centreline bulkhead in sea-going conditions.’

7 Material and General Pipe Design

7.4 Regulations for materials

7.4.1 Metallic materials

(Part only shown)

7.4.1.1 Materials for fuel containment and piping systems shall comply with the minimum regulations given in the following tables:

Table LR 7.1

(Part only shown)

PLATES, PIPES (SEAMLESS AND WELDED) [1, 2], SECTIONS AND FORGINGS FOR FUEL TANKS AND PROCESS PRESSURE VESSELS FOR DESIGN TEMPERATURES NOT LOWER THAN 0°C		
Test temperature	Thickness t (mm) [3]	Test temperature (°C)
	$T \leq 20$	0 (*See* LR 4)
	$20 < t \leq 40$ [3]	-20

Notes

1. For seamless pipes and fittings normal practice applies. The use of longitudinally and spirally welded pipes shall be specially approved by the Administration. (*See* LR 1).
2. Charpy V-notch impact tests are not required for pipes. (*See* LR 5).
3. This Table is generally applicable for material thicknesses up to 40 mm. Proposals for greater thicknesses shall be approved by the Administration. (*See* LR 6).
5. Materials with specified minimum yield stress exceeding 410 N/mm^2 may be approved by the Administration. For these materials, particular attention shall be given to the hardness of the welded and heat affected zones. (*See* LR 3).

LR 6 For plates of thickness greater than 40 mm and up to 50 mm for a design temperature not lower than 0°C, the impact tests are to be conducted in accordance with Table LR 7.1.1.

Table 7.1.1

PLATES, PIPES (SEAMLESS AND WELDED) [1, 2], SECTIONS AND FORGINGS FOR FUEL TANKS AND PROCESS PRESSURE VESSELS FOR DESIGN TEMPERATURES NOT LOWER THAN 0°C with thickness 40mm < *t* ≤ 50mm		
Test temperature	Thickness *t* (mm)	Test temperature (°C)
	40 < *t* ≤ 50	−20 (*see* **LR 6a**)
	40 < *t* ≤ 50	−30 (*see* **LR 6b**)

LR 6a: Applies to Type C independent tanks and process pressure vessels. In addition, post-weld heat treatment shall be performed. Proposals for exemption of post-weld heat treatment based on an alternative approach (e.g. Engineering Critical Assessment in accordance with BS7910 or an equivalent Standard) shall be approved by LR.

LR 6b: Applies to fuel tank other than Type C.

(Part only shown)

Table LR 7.2

PLATES, SECTIONS AND FORGINGS [1] FOR FUEL TANKS, SECONDARY BARRIERS AND PROCESS PRESSURE VESSELS FOR DESIGN TEMPERATURES BELOW 0°C AND DOWN TO MINUS 55°C Maximum thickness 25 mm [2]

Notes

2. For material thickness of more than 25 mm, Charpy V-notch tests shall be conducted as follows:

Material thickness (mm)	Test temperature (°C)
$25 < t \leq 30$	10°C below design temperature or -20°C whichever is lower
$30 < t \leq 35$	15°C below design temperature or -20°C whichever is lower
$35 < t \leq 40$	20°C below design temperature
$40 < t$	Temperature approved by the Administration (*See* LR 1)

The impact energy value shall be in accordance with the table for the applicable type of test specimen. Materials for tanks and parts of tanks which are completely thermally stress relieved after welding may be tested at a temperature

5°C below design temperature or **-**20°C whichever is lower. For thermally stress relieved reinforcements and other fittings, the test temperature shall be the same as that required for the adjacent tank-shell thickness. (*See* **LR 1a**)

~~LR 1 The temperature requirement is subject to agreement with LR.~~

LR 1 For plates of thickness greater than 40 mm and up to 50 mm for a design temperature below 0°C and down to −55°C, the impact tests shall be conducted in accordance with Table LR 7.2.1.

Table LR 7.2.1

	Thickness *t* (mm)	Test temperature (°C)
Test temperature	40 < *t* ≤ 50	5°C below design temperature or –20°C, whichever is lower (*see* LR 1a)
	40 < *t* ≤ 45	25°C below design temperature (*see* LR 1b)
	45 < *t* ≤ 50	30°C below design temperature (*see* LR1b)

LR 1a: Applies to Type C independent tanks and process pressure vessels. Post-weld heat treatment shall be performed. Proposals for exemption of post-weld heat treatment based on an alternative approach (e.g. Engineering Critical Assessment in accordance with BS7910 or an equivalent Standard) shall be approved by LR.

LR 1b: Applies to fuel tank other than Type C.

(Part only shown)

Table LR 7.3

PLATES, SECTIONS AND FORGINGS[1] FOR FUEL TANKS, SECONDARY BARRIERS AND PROCESS PRESSURE VESSELS FOR DESIGN TEMPERATURES BELOW MINUS 55°C AND DOWN TO MINUS 165°C[2]

Maximum thickness 25 mm[3, 4]

Notes

3. For materials 1.5% Ni, 2.25% Ni, 3.5% Ni and 5% Ni, with thicknesses greater than 25 mm**,** the impact tests shall be conducted as follows:

Material thickness (mm)	Test temperature (°C)
$25 < t \leq 30$	10°C below design temperature
$30 < t \leq 35$	15°C below design temperature
$35 < t \leq 40$	20°C below design temperature

The energy value shall be in accordance with the table for the applicable type of test specimen. For material thickness of more than 40 mm, the Charpy V-notch values shall be specially considered. (*See* **LR 5**)

LR 5 For materials 1,5% Ni, 2,25% Ni, 3,5% Ni and 5% Ni, with thicknesses greater than 40 mm and up to 50 mm, the impact tests shall be conducted in accordance with Table LR 7.3.1.

Table LR 7.3.1

Material thickness *t* (mm)	Test temperature (°C)
40 < *t* ≤ 45	25°C below design temperature
45 < *t* ≤ 50	30°C below design temperature

Part B-1

16 Manufacture, Workmanship and Testing

7.4 Regulations for materials

7.4.1 Metallic materials

LR 16.2.-02 Material toughness is to be determined by the Charpy V-notch impact test in accordance with the ~~Rules for Materials~~*Rules for the Manufacture, Testing and Certification of Materials*. In addition, LR may also request other types of tests, such as drop weight or crack tip opening displacement test. When required by *Ch 3, 6.1 Scope 6.1.4* of the *Rules for the Manufacture, Testing and Certification of Materials*, an additional set of Charpy V-notch specimens with axes located on the centreline of thickness of the plate is required.

LR 16.4-01 For Type C independent tanks, manufacture and workmanship are to satisfy the requirements of Ch 13,4 of the Rules for Materials for Class 1 pressure vessels.

LR 16.4-02 ~~For Type C independent tanks, the post-weld heat treatment is to be performed to the requirements of Ch 13,4.10 and 4.11 in the Rules for Materials.~~ For Type C tanks of carbon and carbon-manganese steel with plate thickness up to 40 mm, post-weld heat treatment shall be performed after welding, if the design temperature is equivale or less than −10°C.

For Type C independent tanks with plate thickness up to 40 mm, if the design temperature is higher than −10°C, and for any other carbon and carbon-manganese tanks, the post-weld heat treatment is to conform to the requirements of *Ch 13, 4.10 Post-weld heat treatment* in the *Rules for the Manufacture, Testing and Certification of Materials*.

For Type C tanks of carbon and carbon-manganese steel with plate thickness greater than 40 mm and up to 50 mm, post-weld heat treatment shall be performed after welding. Any proposal for exemption of post-weld heat treatment is to be based on an alternative approach as approved by LR (e.g. Engineering Critical Assessment in accordance with BS7910 or an equivalent standard). Mechanical stress relieving as permitted under *Ch 6, 6.6 Other requirements for construction in metallic materials 6.6.2.3* is not applicable for Type C tanks of carbon and carbon-manganese steel with plate thickness greater than 40 mm and up to 50 mm.

The requirements of *Ch 13, 1.16 Post-weld heat treatment* and *Ch 13, 4.11 Basic requirements for post-weld heat treatment of fusion welded pressure vessels* in the *Rules for the Manufacture, Testing and Certification of Materials* are to be followed for the method and technique of post-weld heat treatment.

16.5 Testing

16.5.2 Type A independent tanks

All type A independent tanks shall be subjected to a hydrostatic or hydro-pneumatic pressure testing. This test shall be performed such that the stresses approximate, as far as practicable, the design stresses, and that the pressure at the top of the tank corresponds at least to the MARVS. When a hydropneumatic test is performed, the conditions shall simulate, as far as practicable, the design loading of the tank and of its support structure including dynamic components, while avoiding stress levels that could cause permanent deformation.

~~**LR 16.5-03** If a hydropneumatic test is utilised, the head of water, h_{HP}, required to model the design pressure, P_{eq}, is to be taken as:~~

~~$h_{\mathrm{HP}} = \dfrac{102\left(P_{eq} - P_{air}\right)}{\rho_r} + y$~~

~~**where**~~
~~h_{HP} = hydropneumatic test head of water, in metres, measured from bottom of cargo tank~~
~~P_{eq} = design pressure, in MPa, at location under consideration as derived from 6.4.9.3.3.1.4~~
~~P_{air} = air test pressure, in MPa~~
~~RD = relative density~~
~~= ρ/ρ_{fw}~~
~~ρ = density of test fluid~~
~~ρ_{fw} = density of freshwater to be taken as 1000 kg/m^3 at 4°C~~
~~y = the vertical distance, in metres, from bottom of tank to the location under consideration, *see* Fig. LR 16.2~~

~~For a given head of water, the load P_{HP}, in MPa, at the location under consideration would be:~~

~~$P_{HP} = P_{air} + (h_{HP} - y)\dfrac{RD}{102}$~~

~~Care is to be given that the ratio~~

~~$\frac{P_{HP}}{P_{eq}} \leq 1{,}0$~~ ~~at any point around the tank.~~

~~**LR 16.5-04** If a hydrostatic test is utilised, the head of water, h_{HS}, required to model the design pressure, P_{eq}, is to be taken as:~~

~~$h_{\text{HS}} = \frac{102\, P_{eq}}{RD} - (h - y)$~~

where

~~h_{HP} = hydrostatic test head of water, in metres, measured above top of cargo tank of depth h~~

~~h = height of tank, in metres, *see* Fig. LR 16.2.~~

~~For a given head of water, the load P_{HS}, in MPa, at the location under consideration would be:~~

~~$P_{\text{HS}} = \left(h_{\text{HS}} + (h - y)\right) \frac{RD}{102}$~~

~~Care is to be given that the ratio~~

~~$\frac{P_{\text{HS}}}{P_{eq}} \leq 1{,}0$~~ ~~at any point around the tank.~~

~~**LR 16.5-05** The test pressure is to be not less than the MARVS and is not normally to exceed the relief valve harbour setting:~~

~~$P_{max} = \left(\frac{t_{min} - 1}{0{,}04\, s\, f \sqrt{k}}\right)^2 MPa$~~

~~The design pressure is not to be exceeded at any point, and the test should adequately load all areas of the tank. *See also* Pt 3, Ch 1, 8.3.6 in the Rules for Ships. When testing takes place after installation of the tanks on board ship, care is to be taken that the test head does not result in excessive local loading on the hull structure. For this purpose, when the cargo tanks are centrally divided with a non-perforated bulkhead, consideration will be given to testing the port and starboard sides of the tank independently.~~

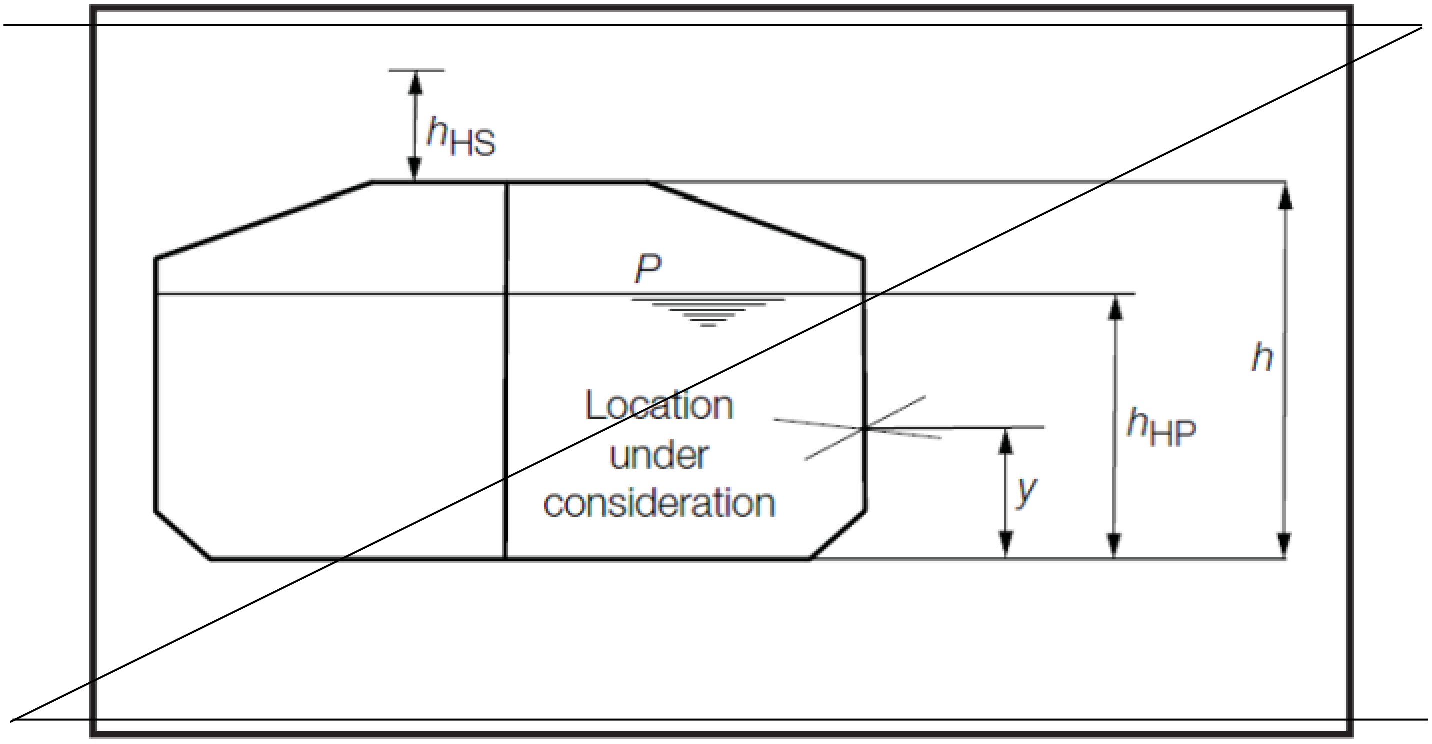

Fig. LR 16.2

LR 16.5-03 If a hydropneumatic or a hydrostatic test is utilised, the test head of water and air pressure are to be specified by designers. Details and procedures of the hydropneumatic or hydrostatic test are to be submitted for approval.

LR 16.5-04 The scantlings of the tanks are to comply with LR 6.4-38, using equivalent internal pressure for the test condition.

LR 16.5-05 The primary structures of the tanks are to comply with *Ch 2, 4.7 Tank test condition* of the *ShipRight Structural Design Assessment Procedure for Type A Tank Liquefied Gas Carriers* and *Ch 2, 4.7 Tank test condition* of the *ShipRight Structural Design Assessment Primary Hull and Cargo Tank Structure of Liquefied Gas Carriers Fitted with Type B Independent Tanks Primarily Constructed of Plane Surfaces* for type A tanks and type B primarily constructed of plane surfaces tanks respectively. The designer may propose an alternative equivalent procedure subject to agreement with LR.

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